Sub a1

1. A laser system that produces radiation at an operative wavelength, the system defining a laser cavity, and the system comprising:

a mode-locking element configured to mode-lock output of the laser system; and

a semiconductor element that produces nonlinear increasing loss at the operative wavelength to enhance stability of the mode-locked output.

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2. The laser system of claim 1, wherein the semiconductor element comprises a semiconductor material that has a band-edge greater than the operative wavelength, such that, at the operative wavelength, the material exhibits two-photon absorption, but not one-photon absorption.

3. The laser system of claim 2, further comprising a reflective structure disposed along an optical path in the cavity, wherein the semiconductor element comprises one or more layers of the material disposed on the reflective structure.

4. The laser system of claim 1, wherein the semiconductor element comprises a semiconductor material that has a conduction band, and the material, when exposed to radiation having the operative wavelength, generates sufficient carriers in the conduction band to initiate sufficient free carrier absorption from the conduction band to produce the nonlinear increasing loss.

5. The laser system of claim 4, further comprising a reflective structure disposed along an optical path in the cavity, wherein the semiconductor element comprises one or more layers of the material disposed on the reflective structure.

6. The laser system of claim 1, further comprising a transmissive structure disposed along an optical path in the cavity, the transmissive structure including the semiconductor element.

7. The laser system of claim 1, wherein the system is tunable to produce radiation over a wavelength range, the wavelength range including the operative wavelength.

8. The laser system of claim 1, wherein the mode-locking element comprises a saturable absorber that passively mode-locks the laser system.

9. The laser system of claim 1, wherein the mode-locking element comprises an external function generator driving a modulator that actively mode-locks the laser system.

10. A laser system that defines a laser cavity, the system comprising:

a pump;

a gain medium that produces radiation at an operative wavelength when pumped by the pump;

a reflector disposed along an optical path in the cavity, the reflector comprising one or more layers of a first semiconductor material that acts as a saturable absorber at the operative wavelength to mode-lock output the laser, and one or more layers of a second semiconductor material that produces nonlinear increasing loss at the operative wavelength to stabilize the mode-locked output.

11. The laser system of claim 10, wherein the second semiconductor material produces two-photon absorption to achieve the nonlinear increasing loss.

12. The laser system of claim 11, wherein the reflector is configured such that, when light having the operative wavelength is incident upon the reflector, a resulting electric field within the reflector forms a standing wave within the reflector.

13. The laser system of claim 12, wherein the standing wave has a local maximum at a location of one or more layers of the first semiconductor material.

14. The laser system of claim 12, wherein the standing wave has a local maximum at a location of one or more layers of the second semiconductor material.

15. The laser system of claim 11, wherein the second semiconductor material comprises InP.

16. The laser system of claim 15, wherein the first semiconductor material comprises InGaAs.

17. The laser system of claim 15, wherein the gain medium comprises an Er/Yb waveguide.

18. The laser system of claim 10, wherein the reflector further comprises a dielectric backmirror configured to reflect light having the operative wavelength.

19. The laser system of claim 10, wherein the reflector further comprises a resonant coating or an anti-reflective coating.

20. A laser system that defines a laser cavity, the system comprising:

a pump;

a gain medium that produces radiation at an operative wavelength when pumped by the pump;

an element that actively mode-locks output of the laser system;

a structure disposed along an optical path in the cavity, the structure comprising a semiconductor material that produces nonlinear increasing loss at the operative wavelength to enhance the stability of the mode-locked output.

21. The laser system of claim 20, wherein the material produces two-photon absorption to achieve the nonlinear increasing loss.

22. The laser system of claim 21, wherein the structure comprises a reflector, the reflector comprising one or more layers of the material.

23. The laser system of claim 21, wherein the structure comprises a transmissive substrate that includes the material.

24. The laser system of claim 23, wherein the structure comprises a waveguide.

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25. The laser system of claim 21, wherein the gain medium comprises erbium doped fiber, and the semiconductor material comprises InP.

26. A method of enhancing the stability of a continuous wave mode-locked output of a laser, the laser defining a cavity and the laser producing radiation at an operative wavelength, the method comprising:

passively mode-locking the output of the laser to produce a continuous train of pulses; and

stabilizing the continuous train of pulses against intensity fluctuations by incorporating into the cavity a semiconductor element that produces a nonlinear increasing loss at the operative wavelength.

27. The method of claim 26, wherein the stabilizing step includes stabilizing the continuous train of pulses against Q-switched mode-locking.

28. The method of claim 26, wherein the mode-locking step includes mode-locking by incorporating a saturable absorber into the cavity.

29. The method of claim 26, wherein the semiconductor element comprises a semiconductor material that exhibits two-photon absorption, but not one-photon absorption, at the operative wavelength to achieve the nonlinear increasing loss.

30. The method of claim 29, wherein the stabilizing step includes incorporating a mirror into the cavity, the mirror having one or more layers that comprise the material.

31. The method of claim 26, wherein the semiconductor element comprises a semiconductor material that exhibits sufficient free carrier absorption at the operative wavelength to achieve the nonlinear increasing loss.

32. A method of suppressing supermodes in the output of an actively mode-locked laser, the laser defining a cavity and the laser producing radiation at an operative wavelength, the method comprising:

actively mode-locking the laser to produce a continuous train of pulses; and

incorporating a semiconductor element into the cavity, the semiconductor element producing a nonlinear increasing loss at the operative wavelength to limit peak intensity of the pulses, and thereby suppress supermodes.

33. The method of claim 32, wherein the semiconductor element comprises a semiconductor material that exhibits two-photon absorption, but not one-photon absorption, at the operative wavelength, to produce the nonlinear increasing loss.

34. The method of claim 33, wherein the incorporating step includes incorporating a mirror into the cavity, the mirror including one or more layers of the material.

35. The method of claim 33, wherein the incorporating step includes incorporating a waveguide into the cavity, the waveguide being partly formed from the material.